AMENDMENTS TO THE SPECIFICATION:

Please insert the following paragraph between the title of the invention and the heading entitled TECHNICAL FIELD OF THE INVENTION on page 1 of the application:

-- The present Application is a continuation of pending U.S. Patent Application No. 10/166,511, filed June 10, 2002, which is a continuation of U.S. Patent Application No. 09/585,060, filed June 1, 2000, now issued as U.S. Patent No. 6,402,367, the contents of each application hereby being incorporated by reference. --

Please amend the paragraph beginning on page 11, line 2 as follows:

FIG. 1A is a schematic illustration of a 2-pole multiphase stator.

Please amend the paragraph beginning on page 11, line 3 as follows:

FIG. 1B is a schematic illustration of a multipole stator.

Please amend the paragraph beginning on page 11, line 4 as follows:

FIG. 1C is a graphic illustration of the electric current as a function of time for each pair of coils of the stator [[if]] in FIG. 1A.

Please amend the paragraph beginning on page 11, line 6 as follows:

FIG 1D is a schematic illustration of a multiphase stator having pairs of coils positioned longitudinally relative a cylindrical mixing volume.

Please amend the paragraph beginning on page 11, line 8 as follows:

FIG. [[1]]2A is a schematic front elevational view of a magnetomotive stirring volume defined by a stacked stator assembly having three individual stators according to a first embodiment of the present invention.

Please amend the paragraph beginning on page 11, line 11 as follows:

FIG. [[1]]2B is a schematic front elevational view of a magnetomotive stirring volume defined by a stacked stator assembly having two individual stators according to a second embodiment of the present invention.

Please amend the paragraph beginning on page 11, line 14 as follows:

FIG. [[1]]2C is a schematic front elevational view of a magnetomotive stirring volume defined by a stacked stator assembly having four individual stators according to a third embodiment of the present invention.

Please amend the paragraph beginning on page 11, line 17 as follows:

FIG. [[1]]2D is a schematic front elevational view of a magnetomotive stirring volume defined by a stacked stator assembly having five individual stators according to a fourth embodiment of the present invention.

Please amend the paragraph beginning on page 11, line 20 as follows:

FIG. [[2]]3A is a schematic front elevational view of the magnetomotive stirring volume of FIG. [[1]]2A illustrating the simplified magnetic field interactions produced by each individual stator of a first stator assembly.

Please amend the paragraph beginning on page 12, line 1 as follows:

FIG. [[2]]3B is a schematic front elevational view of the combination of magnetomotive forces from each stator of the stator assembly of FIG. [[2]]3A to generate a substantially spiral resultant magnetic field.

Please amend the paragraph beginning on page 12, line 4 as follows:

FIG. [[2]]3C is a schematic front elevational view of the magnetomotive stirring volume of FIG. [[1]]2A illustrating the simplified magnetic field interactions produced by each individual stator of a second stator assembly.

Please amend the paragraph beginning on page 12, line 7 as follows:

FIG. [[2]]3D is a schematic front elevational view of the combination of magnetomotive forces from each stator of the stator assembly of FIG. [[2]]3C to generate a substantially spiral resultant magnetic field.

Please amend the paragraph beginning on page 12, line 10 as follows:

FIG. [[3]]4A is a schematic diagram illustrating the simplified shape of a magnetic field produced by a rotating field stator of FIG. [[1]]2A.

Please amend the paragraph beginning on page 12, line 12 as follows:

FIG. [[3]]4B is a schematic diagram illustrating the simplified shape of a magnetic field produced by a linear field stator of FIG. [[1]]2A.

Please amend the paragraph beginning on page 12, line 14 as follows:

FIG. [[3]]4C is a schematic diagram illustrating the simplified substantially spiral magnetic field produced by combining the rotating field and linear field stators of FIG. [[1]]2A.

Please amend the paragraph beginning on page 12, line 17 as follows:

FIG. [[3]]4D is a perspective schematic view of the cylindrical spiral magnetomotive mixing volume of FIG. [[1]]2A separated to illustrate an inner cylindrical core portion and an outer cylindrical shell portion.

Please amend the paragraph beginning on page 12, line 19 as follows:

FIG. [[3]]4E is a perspective schematic view of the outer portion of FIG. [[3]]4D.

Please amend the paragraph beginning on page 12, line 20 as follows:

FIG. [[3]]4F is a perspective schematic view of the inner portion of FIG. [[3]]4D.

Please amend the paragraph beginning on page 12, line 21 as follows:

FIG. [[4]]5 is a schematic view of a sixth embodiment of the present invention, a magnetomotive stirring apparatus having an electronic controller connected to a stator assembly and receiving voltage feedback.

Please amend the paragraph beginning on page 13, line 1 as follows:

FIG. [[5]]6 is a schematic view of a seventh embodiment of the present invention, a magnetomotive stirring apparatus having an electronic controller connected to a stator assembly and receiving temperature feedback from temperature sensors.

Please amend the paragraph beginning on page 15, line 5 as follows:

In the past, MHD stirring has been achieved by utilizing a 2-pole multiphase stator system to generate a magnetomotive stirring force on a liquid metal. While multipole stator systems are well known, they have not been in the MHD process because, for a given line frequency, multiphase stator systems generate rotating magnetic fields having only one half the rotational speed of fields produced by 2-pole stator systems. FIG. 1A schematically illustrates a 2-pole multiphase stator system 1 and its resulting magnetic field 2, while FIG. 1B schematically illustrates a multipole stator system 1' and its respective magnetic field 2'. In general, each stator system 1, 1' includes a plurality of pairs of electromagnetic coils or windings 3, 3' oriented around a central volume 4, 4' respectively. The windings 3, 3' are sequentially energized by flowing electric current therethrough.

Please amend the paragraph beginning on page 15, line 17 as follows:

FIG. 1A illustrates a 3-phase 2-pole multiphase stator system 1 having three pairs of windings 3 positioned such that there is a 120 degree phase difference between each pair. The multiphase stator system 1 generates a rotating magnetic field 2 in the central volume 4 when the respective pairs of windings 3 are sequentially energized with electric current. In the instant case, there are three pairs of windings 3 oriented circumferentially around a cylindrical mixing volume 4, although other designs may employ other numbers of windings 3 having other orientations.

Please amend the paragraph beginning on page 16, line 1 as follows:

Typically, the windings or coils 3 are electrically connected so as to form a phase spread over the stirring volume 4. FIG. 1C illustrates the relationship of electric current through the windings 3 as a function of time for the windings 3.

Please amend the paragraph beginning on page 16, line 14 as follows:

FIG. 1D illustrates a set of windings 3 positioned longitudinally relative a cylindrical mixing volume 4. In this configuration, the changing magnetic field 2 induces circulation of the liquid electrical conductor in a direction parallel to the axis of the cylindrical volume 4.

Please amend the paragraph beginning on page 16, line 18 as follows:

In FIG. 1B, a multipole stator system 1' is illustrated having four poles, although the system 1' may have any even integral number P of poles. Assuming sinusoidal distribution, the magnetic field B is expressed as

$$B = B_m \cos P/2\ \theta_s,$$

where B_m is the magnetic density at a given reference angle $\theta_{s\ is}$. The value P/2 is often referred to as the electrical angle. It should be noted that the magnetic field 4' produced by the multipole multiphase stator system 1' produces a resultant magnetic field 2' having two-dimensional cross-section with a central area of substantially zero magnetic field.

Please amend the paragraph beginning on page 18, line 19 as follows:

FIGs. [[1]]2A, [[2]]3A-[[2]]3B, and [[3]]4A-[[3]]4F illustrate a first embodiment of the present invention, a magnetomotive agitation system 10 for stirring volumes of molten metals (such as melts or slurry billets) 11. As used herein, the term "magnetomotive" refers

to the electromagnetic forces generated to act on an electrically conducting medium to urge it into motion. The magnetomotive agitation system 10 includes a stator set 12 positioned around a magnetic mixing chamber 14 and adapted to provide a complex magnetic field therein. Preferably, the mixing chamber 14 includes an inert gas atmosphere 15 maintained over the slurry billet 11 to prevent oxidation at elevated temperatures.

Please amend the paragraph beginning on page 19, line 4 as follows:

The stator set 12 preferably includes a first stator ring 20 and a second stator ring 22 respectively positioned above and below a third stator ring 24, although the stator set may include any number of stators (ring shaped or otherwise) of any type (linear field, rotational field, or the like) stacked in any convenient sequence to produce a desired net field magnetomotive shape and intensity (see, for example, FIGs. [[1]]2B-[[1]]2D). As used herein, a 'rotating' or 'rotational' magnetic field is one that directly induces circulation of a ferromagnetic or paramagnetic liquid in a plane substantially parallel to a central axis of rotation 16 extending through the stator set 12 and the magnetic mixing volume 14. Likewise, as used herein, a 'linear' or 'longitudinal' magnetic field is one that directly induces circulation of a ferromagnetic or paramagnetic material in a plane substantially parallel the central axis of rotation 16. Preferably, the stator ring set 12 is stacked to define a right circular cylindrical magnetic mixing volume 14 therein, although the stator set 12 may be stacked to produce a mixing volume having any desired size and shape.

Please amend the paragraph beginning on page 20, line 14 as follows:

FIGs. [[1]]2A, [[2]]3C-[[2]]3D, and [[3]]4A-[[3]]4F illustrate an alternate embodiment of the present invention, a magnetomotive agitation system 10' as described above, but having a stator ring set 12' including a first and second stator 20', 22', each adapted to produce a linear magnetic field 30', 32', and a third stator 24' adapted to produce a rotational magnetic field 34'. As above, when all three stators 20', 22', 24' are actuated, the magnetic fields 30', 32', 34' so produced interact to form a complex substantially spiral or pseudo-spiral magnetomotive field 40. The substantially spiral magnetomotive field 40 produces an electromotive force on any electrical conductors in the magnetic mixing chamber 14, such that they are circulated throughout the melt 11, both axially and radially. Electrical conductors acted on by the spiral magnetomotive field 40 are therefore thoroughly dispersed. This stator set 12' design offers the advantage of directly inducing longitudinal circulation in both ends of the mixing volume 14 to ensure complete circulation of the slurry billet 11 at the ends of the mixing volume 14.

Please amend the paragraph beginning on page 21, line 4 as follows:

FIGs. [[3]]4A-[[3]]4F illustrate the stirring forces resulting from the interaction of the magnetic forces generated by the present invention in greater detail. FIGs. [[3]]4A-[[3]]4C are a set of simplified schematic illustrations of the combination of a rotational or circumferential magnetic field 30 with a longitudinal or axial magnetic field to produce a resultant substantially spiral magnetic field 40. By itself, the rotational magnetic field produces some circulation 42 due to the centripetal forces urging stirred material against and

down the vessel walls, but this is insufficient to produce even and complete circulation. This is due primarily to frictional forces producing drag at the interior surfaces of the mixing vessel 26. The circumferential flow generated by the rotational magnetic field 30 (shown here as a clockwise force, but may also be opted to be a counterclockwise force) is coupled with the axial flow generated by the longitudinal magnetic field 34 (shown here as a downwardly directed force, but may also be chosen to be an upwardly directed force) to produce a downwardly directed substantially spiral magnetic field 40. As the molten metal 11 flowing downward near the interior surface of mixing vessel 26 nears the bottom of the mixing volume 14, it is forced to circulate back towards the top of the mixing volume 14 through the core portion 48 (see FIGs. [[3]]4D-[[3]]4F) of the mixing vessel 26, since the magnetomotive forces urging downward flow are stronger nearest the mixing vessel walls 26. Likewise, the direction of the longitudinal magnetic field 34 may be reversed to produce an upwardly directed flow of liquid metal having a downwardly directed axial portion. It should be noted that the stator set 12 may be controlled to produce net magnetic fields having shapes other than spirals, and in fact may be controlled to produce magnetic fields having virtually any desired shape. Likewise, it should also be noted that the spiral (or any other) shape of the magnetic filed may be achieved by any stator set having at least one stator adapted to produce a rotational field and at least one stator adapted to produce a linear field through the careful control of the field strengths produced by each stator and their interactions.

Please amend the paragraph beginning on page 22, line 9 as follows:

FIGs. [[3]]4D-[[3]]4F schematically illustrate the preferred flow patterns occurring in a metal melt 11 magnetomotively stirred in the substantially cylindrical magnetic mixing chamber or volume 14. For ease of illustration, the magnetic mixing volume 14 is depicted as a right circular cylinder, but one of ordinary skill in the art would realize that this is merely a convenient approximation of the shape of the magnetomotive force field and that the intensity of the field is not a constant throughout its volume. The magnetic mixing volume 14 may be thought of as comprising a cylindrical outer shell 46 surrounding a cylindrical inner axial volume 48. The downwardly directed spiral portion 54 of the flowing liquid metal 11 is constrained primarily in the cylindrical outer shell 46 while the upwardly directed axial portion 56 of the flowing liquid metal 11 is constrained primarily in the cylindrical inner axial volume 48.

Please amend the paragraph beginning on page 24, line 16 as follows:

FIG. [[4]]5 schematically illustrates a still another embodiment of the present invention, a magnetomotive agitation system 10A for stirring thixotropic molten metallic melts including an electronic controller 58 electrically connected to a first stator 20, a second stator 22 and a third stator 24. A first power supply 60, a second power supply 62 and a third power supply 64 are electrically connected to the respective first, second and third stators 20, 22, 24 as well as to the electronic controller 58. A first voltmeter 70, a second voltmeter 72 and a third voltmeter 74 are also electrically connected to the respective power supplies 60, 62, 64 and to the electronic controller 58.

Please amend the paragraph beginning on page 25, line 15 as follows:

FIG. [[5]]6 illustrates yet another embodiment of the present invention, a magnetomotive agitation system 10B for stirring a thixotropic metallic melt 11 contained in a mixing vessel 26 and including an electronic controller 58 electrically connected to a first stator 20, a second stator 22 and a third stator 24. The electronic controller 58 is also electrically connected to one or more temperature sensors 80, 82 such as an optical pyrometer 80 positioned to optically sample the metallic melt 11 or a set of thermocouples 82 positioned to detect the temperature of the metallic melt 11 at different points within the mixing vessel 26.